number of rows and any convenient spacing between the rows may be made as desired. Tufting machines similar to those in the carpet-making industry may be used, modified to tuft through several spaced layers. Various kinds of stitching may be performed at this station as this invention is not limited to the precise configuration of the three-dimensional reinforcement.

After the three-dimensional reinforcement matrix has been made from the layers of fabric and the vertical stitching, the matrix network is then subjected to the foaming operation as represented by the foam input trough **58** and foam pipes **60.** Preferably, these pipes extend across the width of the trough between the endless belts and have a plurality of holes in the pipes through which the insulation foam may be extruded. These pipes are connected to a foaming machine **62** which in turn is connected to a foam reservoir supply **64.** This foam expands and swells up through the fabric layers between the belts as the belts move the fabric reinforcement matrix down to its next station. As previously mentioned, the foaming operation per se is well known and need not be further described here.

FIG. **2** is a sectional view taken along the line **2—2** of FIG. **3.** Here is shown the trough formed by side belts **46, 46**A and lower belt **68.** Slits **47** and **47**A grip the side edges of the various layers to maintain them in spaced relationship, as shown. Multiple rows of vertical stitching **50** pass between the layers. At this point along the production line the foam **70** has risen part way although it will continue to rise to the top as the belts move the composite further along the production line.

Referring back to FIG. **1,** upper belt **66** and a lower belt **68** form the top and bottom of the trough and limit the vertical movement of the foam until it has sufficiently cured and stabilized. By limiting the vertical foaming movement, a more dense insulation can be provided if desired. Heat and time usually are the factors which result in the conversion of the foamy substance into an insulation of lightweight, closed cell material **70.** Both belts **66** and **68** preferably are of an elastometer having a low chemical adhesion. Most elastometers are natural parting agents and will not adhere to the particular foam used. These belts also may have a spray TFE tetrafluoroethelene fluorol carbon parting agent coating over its surface in order to prevent its adhesion by the polyurethane foam which is preferable as the insulation material. The upper and lower endless belt surfaces **66** and **68** are of sufficient length in the conveyor system that the foaming has solidified sufficiently to become self-supporting. Rollers **72, 74** define the plane of the upper surface and a plurality of rollers **76, 78, 80, 82** and **84** define the lower surface **68.** Rollers **86** and **88** are return rollers to the lower belt and rollers **90, 92** are return rollers for the upper belt. Rollers **94, 96** and **98** simply support the return of upper belt **66** and rollers **100, 102, 104, 106, 108, 110** support the return of lower belt **68.** Rollers **112, 114** and **116** simply cause appropriate depression in the upper plane of the lower belt to permit foam input pipes **60** at the foaming station to be above the belts and below the lowermost layer **44** of the reinforcement fabric.

After the polyurethane closed cell foam has solidified and become rigid it continues its output movement in the direction of arrow **118.** In the illustrative embodiment the thickness of the usable insulation output is on the order of 5 inches and the width is on the order of

2 feet. It may have an infinite length and may be cut into appropriate lengths as desired.

FIG. **3** shows in perspective a portion of the insulative product resulting from the method and apparatus of the present invention. Here is shown the various layers **34, 36, 38, 40, 42** and **44** of reinforcement in spaced relationship with a plurality of rows **50** of loops passing through the layers. The upper ends of these loops may be exposed above the embedding insulation **46,** as shown, and may be used in bonding the insulation to a surface to be protected. Alternately, the loops may be completely covered with foam if desired.

Having thus described an illustrative embodiment of the present invention, it is to be understood that modifications thereof will become apparent to those skilled in the art and that these deviations are to be construed as part of the present invention.

I claim:

1. The method of making three-dimensional fiber reinforced insulation comprising the steps of:

1. positioning several layers of reinforcing material in predetermined vertically stacked and spaced relationship with the layers being in substantially horizontal planes,
2. passing multiple rows of fibers vertically through said layers with loops under the lowermost layer and over the uppermost layer to form a three-dimensional matrix,
3. injecting a foamable insulation material into said matrix and allowing it to foam around and through said matrix, and
4. thereafter cure the resulting composite into a self-supporting structure suitable for adhering to a container.

2. The method as set forth in claim **1** wherein the loops over the uppermost layer are not covered with said insulation.

3. The method as set forth in claim **1** wherein said rows extend longitudinally along the length of the matrix.

4. The method as set forth in claim **1** wherein the side edges of said layers are gripped and moved in passing said layers to a first station where the multiple rows of fibers are passed therethrough and in passing said matrix to another position where the injecting of the foamable insulation material occurs.

5. The method as set forth in claim **1** wherein said layers, matrix and foamable insulation material are moved from station to station for the various operations thereon.

6. Apparatus for making three-dimensional fiber reinforced insulation in accordance with the method of claim **1,** said apparatus comprising conveyor means for gripping and moving the several layers in stacked and spaced relationship, tufting machines at a first station for passing multiple loops through the layers as they move past said tufting machines, a foam machine at another station for injecting a foamable insulation material, and side and bottom sections forming a trough which contains said matrix therein and which confines said foamable material until it has stabilized into an insulation material.

7. Apparatus as set forth in claim **6** and, a top section on said trough to limit vertical expansion of said foam and thus provide greater density of said insulation material.

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